Appendix D. Future Prospects: Advances and Threats to Great Lakes Water Resources and Management

Appendix D. Future Prospects: Advances and Threats to Great Lakes Water Resources and Management

The Great Lakes Stakeholder Survey was designed and conducted by the Great Lakes Commission. The survey results are presented in Appendix C and were obtained from Great Lakes partners and stakeholders. Water resources priorities were identified which relate to Corps of Engineers programs, strategic goals, objectives, and key actions. The following 11 subsections correspond to the water resources priorities derived from the survey and include an analysis of future alternative scenarios, both positive and negative, which are described in terms of:
a) Need: a short definition of the need(s) underlying the priority;
b) Current Trend: a discussion of factors that presently impact this need;
c) Advances: a forward looking and positive projection of current and future Corps programs and policies, and their potential role in meeting the identified need(s); and,
d) Threats: a similar forward looking but negative projection of Corps programs and policies, and their potential role in not addressing the identified need(s).

Great Lakes Water Resources Priorities

D-1. Integrating Economic and Environmental Needs

Need:

- Recognize the complementarity of economic and environmental needs in Great Lakes management.

Current Trend

Many stakeholders experience an imbalance and disconnect of environmental and economic objectives in Great Lakes management. A number of tribal representatives, state natural resources managers, and environmental organizations experience that environmental needs are shortchanged in favor of unsustainable short-term economic gains. Responses to the survey also indicate adversities between certain economic interests and environmental agencies; some economic interests experience environmental obligations as oppressive and economically unsustainable.

In the survey, stakeholders rated current efforts to achieve environmental sustainability of water resources development projects as "somewhat adequate". This implies that the environmental considerations and protection measures taken by the Corps Great Lakes districts in connection with Civil Works project may meet some reluctant approval, but with a lot of room for improvements.

Future Scenario: Advances

Environmental and economic objectives will not only be balanced but fully integrated. Consensus between economic interests and environmental agencies will be based on managing the Great Lakes for ecological and economic sustainability. All parties make an effort to overcome the criticism of producing more rhetoric than action with regards to embracing the sustainability concept. A vision of sustainability for the Great Lakes basin is being pursued in which today's society makes every possible effort to meet its needs without compromising the ability of future generations to meet their own needs.

The planning and execution of water resources development projects by the Corps of Engineers is philosophically based on the sustainability concept. The flood control mission gives preferences to non-structural over structural approaches whenever feasible. The construction of navigation and other structural projects is carefully planned and executed to minimize environmental impacts. Environmental policies are based on the ecosystem approach and fully incorporated in project planning and execution. The de-compartmentalization of planning and execution of water resources-related and other authorities, as well as strong coordination with other agencies and interests, enables the Corps to use its capabilities and resources to address integrated economic and environmental objectives in key areas, such as waterfront revitalization (see D-8) or sediment management (see D-9).

Future Scenario: Threats

The Great Lakes community fails to integrate environmental and economic objectives. Long-term sustainability keeps getting short-changed in favor of short-term economic benefits or political gains. Adversities and personal vendettas obstruct constructive interactions between economic interests, environmental agencies, and citizen organizations. Great Lakes management continues to be an outgrowth of serving disparate interests.

Water resources development projects of the Corps are associated with cronyism. This is partly the result of a failure to address shortcomings in project planning that have been pointed out in the past. For example, nothing has been done to improve the evaluation of economic benefits and environmental impacts of projects. Pork-barreled projects meet the needs of certain local interests with strong political ties but erode the Corps' credibility for being committed to basinwide sustainability goals.

D-2. Great Lakes Restoration Plan

Needs:

- Shared management priorities and restoration goals for the Great Lakes basin.
- Full-scale restoration of the Great Lakes ecosystem.

Current Trend

The majority of surveyed stakeholders agree that current efforts to restore the Great Lakes ecosystem are insufficient. The single-largest issue, according to the GAO analysis: *Great Lakes - an Overall Strategy and Indicators for Measuring Progress are Needed to Better Achieve Restoration Goals*, is the lack of an overarching strategy to restore the Great Lakes ecosystem. Even though there are hundreds of restoration programs available, they cannot succeed without a common strategy. Restoration efforts are also impeded by the lack of a commonly held vision among stakeholders. Different interests continue to advocate for different priorities. It follows that there is no unified effort among the different stakeholders to work with the Great Lakes congressional delegation. The scatter dilutes efforts to elevate Great Lakes issues to a national level. The lack of a unified restoration effort stands in stark contrast to the strong public support that such an endeavor might receive. In a recent survey conducted for the Biodiversity Project and the Joyce Foundation, large majorities of basin residents see it as their personal responsibility to protect the Great Lakes and also say that more needs to be done.

Annex 14 of the Great Lakes Water Quality Agreement (GLWQA) of 1987 called for the development and implementation of Remedial Action Plans to clean up contaminated sediments in Great Lakes Areas of Concern. However, both the development and the implementation of RAPs have been taken much longer than anticipated; only two of 42 originally identified AOCs have since been delisted, both on the Canadian side of the lakes. A chronic shortage for RAP funding has been a major obstacle to timely progress. The passing of the Great Lakes Legacy Act in 2002 was welcomed as a long-needed step into the right direction. The Act commits a total of $270 over five years for the cleanup of contaminated sediments in Great Lakes Areas of Concern (AOCs). However, even if fully funded, the Legacy Act would only allow for the cleanup of a small fraction of the 31 U.S. and binational AOCs. The U.S. government has recently estimated that it will cost more than $7.4 billion to restore beneficial uses in all U.S. AOCs.

It is not to say that there hasn't been any progress at all. There is consensus on the importance of cleaning up toxic hot spots and to restoring and protecting water quality, fish and wildlife, and rivers and stream corridors across the basin and the accomplishments of existing programs to achieve these goals are generally recognized. But both the decision-makers as well as the public agree that much more needs to be done to adequately restore the Great Lakes ecosystem.

Future Scenario: Advances

A large scale, long-term Great Lakes restoration plan has been developed and is being implemented. The plan spells out a commonly shared vision of stakeholders and has clearly defined, consensus-based ecosystem objectives and restoration goals. Rather than remaining a pipe dream, the plan has become an authoritative strategic document that enables management coordination among the many institutions that have partnered up for the full-scale restoration of the Great Lakes ecosystem.

The full-scale restoration effort owes its success to the support of the basin's population. Surveys affirm the regional population's perspective that the Great Lakes are very important. Success stories have garnered this type of support, such as the appropriation of funds for the Great Lakes Legacy Act and how they are being maximized for the restoration of beneficial uses. The overall impression is that Great Lakes priorities are being properly addressed, since the national significance of these issues is fully recognized and adequate levels of funding are allocated.

Specified restoration goals (e.g. full implementation of GLWQA) are being accomplished by achieving specified targets, such as cleaning up of toxic hot spots (full implementation of RAPs), successful conservation of key stone fish and wildlife species, and the hydrologic and ecological restoration of Great Lakes tributaries.

Future Scenario: Threats

Despite all the rhetoric, there is still no overarching restoration plan for the Great Lakes. The Legacy Act and other programs rarely ever get fully funded. There is no shared vision of stakeholders, no defined set of consensus-based restoration goals, no agreement on quantifiable indicators of progress. No measurable, significant progress, if not regress, toward restoration of the Great Lakes ecosystem has been made.

Recent years have also seen a change of the public perspective with regards to Great Lakes issues. Public support for restoration efforts is dwindling, mostly because of the lack of progress and consensus. Disparate political advocacy efforts create but a lackluster profile of the Great Lakes basin on the national level. As a result, Great Lakes restoration efforts remain low on the list of national priorities and keep lagging behind other initiatives.

D-3. Program Funding

Need:

- Sufficient funding for critical water resources programs in the Great Lakes basin.

Current Trend

There are a number of critical programs that either were never funded or are chronically underfunded to achieve their objectives. Stakeholders have repeatedly cited the Great Lakes Remedial Action Plans and Sediment Remediation program of the Corps (Section 401, WRDA 1990). For this and a number of additional programs, the current level of funding does not allow these restoration projects to move from the initial planning phase to implementation and management. While the lack of funding is the largest barrier for restoration programs, the current lack of coordination of program funding makes the use of limited available resources less efficient also.

The constraints of state, tribal, and local budgets also keep potential sponsors from soliciting federal programs for local projects, even if these might have good prospects for being funded. Cost sharing and other requirements are often not met and projects are not implemented.

Another factor that delays needed projects is an inconsistent flow of federal funding. Authorized projects that could be constructed in a relatively short amount of time are frequently deferred because they are not being funded consistently up to the conceived project completion

date. Often, funds aren't available for many years after project authorization. Or, funding is discontinued halfway into the project due to shifting priorities and budget ceilings in the annual appropriation process.

Future Scenario: Advances

In a best-case scenario, all the critical programs are fully funded to move restoration projects from planning to implementation. The funding for multiple programs is coordinated to maximize resources. Projects are implemented because federal program funds are available and local project sponsors of approved projects are able to find access to funds to meet cost-share and other requirements. Funded projects strategically address priority ecosystem management goals and restoration targets. Project funding is consistent; projects are funded for their entire term and implemented in a timely manner.

Future Scenario: Threats

Critical programs remain unfunded or underfunded and there is no visible progress toward ecosystem management goals and restoration targets. Since there is no program funding coordination, inefficient if not wasteful program spending is common. Critical projects are abandoned because local project sponsors are unable to meet cost-share and other requirements. Since project funding is inconsistent; necessary projects are either inactive or deferred, some are eventually deauthorized.

D-4. Invasive Species

Need:

- Prevention and control of invasive aquatic nuisance species (ANS) is one of the most challenging environmental concerns among Great Lakes stakeholders.

Current Trend

Over the past two centuries, more than 160 non-indigenous aquatic species have entered the Great Lakes. The number of species established per decade has increased with time, and none has subsequently become extirpated. Since 1970, on average, there has been one invader recorded every eight months. While resource managers strive for a "zero discharge" policy for these biological pollutants, there are currently no signs for a reversal of this upward trend.

As of now, strategies and methods for prevention and control are often lagging behind the introduction and spread of invaders. The threat of a new invasion is often not recognized until after the invasive species has established itself with a successfully reproducing population. Once an invasion spreads beyond manageable geographic boundaries, control measures are often unfeasible even if a control mechanism is known.

Two of the priority needs identified by the National Invasive Species Council are: 1) assess and better control pathways of introduction to prevent invasions; and, 2) early detection and rapid response to prevent the spread of newly discovered invasive species. Once introduction pathways have been identified and analyzed, control mechanisms can be identified to prevent the spread. For example, boaters, anglers, and other users are known to spread invasive species as uninvited hitchhikers from one lake or stream to another. Hence, education and outreach are an important element of strategies to control invasive species.

The priority needs above can only be met if a working monitoring system is in place that can readily identify non-indigenous species that might be introduced, are being introduced, or are already in place. For example, monitoring efforts were successful in tracking the movement of the Asian carp up the Mississippi River and bringing attention to this imminent risk for the Great Lakes. Monitoring will also an important element of measuring progress of invasive species controls. Currently, there are often no data to assess population changes or other measures of progress.

A successful, proactive response to an imminent invasion threat also depends on whether the capacities and resources are available when necessary. Even though there is a strong institutional network addressing the problem of invasive species in the Great Lakes basin, its current capacities are overwhelmed with the tasks of adequately monitoring threats, identifying effective control mechanisms, and managing control efforts. The failure of current control approaches is related not only to a lack of staffing and funding but also to the complexity of the problem.

The spread of established invaders, such as the zebra and quagga mussels, is often difficult to contain for the lack of an effective and appropriate control measure. In addition, it is often difficult to weigh the benefits and risks of certain actions. For example, does the benefit of exterminating zebra mussels by treating an infested area with rotenone outweigh the adverse effect of unintentionally killing native and possibly rare species? Resource managers are currently facing this dilemma in the development of a rapid response plan for Lake Superior islands that are threatened by a zebra mussel infestation.

The survey responses indicate that stakeholders place a considerable value on the dispersal barrier in the Chicago Sanitary and Shipping Canal. The installation of a backup generator is welcomed as a necessary safety measure and it is hoped that the barrier will keep Asian carp out of the lakes. However, resource managers see a possible invasion of the Great Lakes by Asian carp as too much of a risk to rely on the barrier only. A rapid response plan includes rotenone treatment of the Shipping Canal if the Asian carp are spotted above the dispersal barrier.

In any case, the dispersal barrier is merely a singular effort to address a specific facet of a vast and complex problem; the barrier may keep Asian carp out of the Great Lakes and Eurasian ruffe out of the Mississippi. But since it is a specific measure to prevent fish migration, the barrier has no bearing on smaller aquatic life, such as invertebrates or planktic algae. The feasibility of additional dispersal barriers for all waterways connecting the Great Lakes with other watersheds seems cost-prohibitive and unfeasible.

Future Scenario: Advances

Ideally, “zero discharge” will become a reality and new invasions will be entirely prevented. The National Invasive Species Act (NISA) will be reauthorized, providing for continued federal legislation that identifies long-term objectives and quantifiable performance measurements. Control measures are based on state-of-the-art response plans that integrate cost-benefit analyses with ecological risk assessments. The Chicago Sanitary and Shipping Canal dispersal barrier will keep Asian carp out of the lakes. Ballast water exchange policies will be successful; partly due to the breakthrough in the development of effective ballast water treatment technologies but also due to the voluntary compliance of oceangoing ships with ballast exchange

requirements. The successes in combating invasive species form the basis for the success of other ecosystem restoration efforts.

Future Scenario: Threats

The rate of species introductions continues to increase. Due to a shift in national priorities, NISA is not reauthorized by Congress. Due to the lack of federal legislation, the Great Lakes community fails to establish long-term objectives and existing policies leave many loopholes for certain interests to continue mistakes of the past. Either due to human or technical error, the dispersal barrier fails and allows the entry of silver and black carp species into the Great Lakes. Bighead carp are found to reproduce in Lake Erie, after all. Ballast-water exchange policies remain ineffective; additional freshwater and brackish water species from all over the world keep getting introduced into the Great lakes. The issue of negligence is exacerbated by the failure to develop economically feasible technologies for ballast water treatment. Certain epidemics in parts of the Great Lakes populations as well as outbreaks of fish-diseases have been associated with the introduction of waterborne pathogens to the region. The losing battle against invasive species costs additional billions of dollars in losses to the economy and control efforts. It also dims the outlook for fish and wildlife restoration efforts to restore in the basin. Trend assessments show that fish and wildlife populations are becoming more homogeneous and biodiversity is being lost in the basin.

D-5. Fish and Wildlife Habitat

Need:

- Boost efforts to restore fish and wildlife habitat.

Current Trend

There is a sense of general frustration about ongoing efforts to restore wetlands and other habitat in the Great Lakes basin. The problems with fish and wildlife habitat restoration, as seen by the surveyed stakeholders, match findings of the GAO report: *Great Lakes - an Overall Strategy and Indicators for Measuring Progress are Needed to Better Achieve Restoration Goals.* Often, funding is missing to implement important projects, such as the restoration of lost spawning headwaters and the creation of fish passages in Great Lakes tributaries. Moreover, there is no coordination of the existing federal programs and no monitoring of their success or failure in achieving defined objectives. *A Joint Strategic Plan for Management of Great Lakes Fisheries* and other strategic documents by the GLFC and the FWS broadly define strategic goals for fish habitat restoration, yet these strategies focus on salmonids and other sport fish of commercial value. Still needed are program priorities to guide coastal habitat restoration based on broader ecosystem goals for the Great Lakes basin that include and also go beyond these immediate fishery management concerns. Such regional ecosystem goals are, for example, defined in the *Great Lakes Ecoregional Plan,* which is being developed by a team of experts under the auspices of The Nature Conservancy. Yet there continues to be a disconnect between such regional, science-based restoration approaches and the planning and execution of federal restoration programs

The lack of comprehensive data prevents an exacting evaluation of coastal wetland losses in the Great Lakes. This lack of information adds to the difficulties of developing science-based, quantifiable habitat restoration targets for the basin. Nonetheless, it is an established fact that the

loss of coastal wetlands and their functions continues, posing an ongoing and serious threat to the biological integrity of the Great Lakes ecosystem. As described earlier (Section 6.E.2), there are numerous pressures causing these losses of coastal wetland acreage and functions. One of the major issues is habitat fragmentation. This problem will worsen as long as new development in the coastal zone continues without effective land-use and wetland conservation policies.

Numerous water resources projects of the Corps have left a legacy of degraded coastal habitat. Several projects for navigation and flood protection in the Great Lakes basin, including the Soo Locks and a number of dams, have been connected with negative impacts on habitat. These impacts include the disruption of the natural flow regimes in wetlands, shore alteration (hardening), shoreline erosion, and siltation in vulnerable habitat areas. Section 1135 of WRDA provides for the mitigation of such damages.

Another pressing issue is the current lack of clearly defined jurisdiction over isolated wetlands, i.e. wetlands that are not directly connected to navigable surface waters. The Corps and the EPA have a joint responsibility to protect wetlands connected to navigable surface waters (Section 404, CWA amendments of 1977). The EPA recently removed federal protection from certain isolated wetlands considered "navigable waters" due to previous litigation efforts.

Future Scenario: Advances

Habitat restoration needs in the Great Lakes basin are adequately addressed by fully funded government programs. All restoration programs are strategically coordinated to address clearly defined priorities for the Great Lakes ecosystem. Initiatives such as TNC's *Great Lakes Ecoregional Plan* have led the way to establish these priorities. A comprehensive coastal wetland inventory for the Great Lakes basin is used to gauge progress toward restoration efforts and as a decision-making tool for policy makers.

The acreage of coastal wetland is increasing again to meet specified ecoregional targets. These targets include the preservation of habitat connectivity along the coast, the effective remediation of coastal wetland hydrology and other system functions, and the protection of keystone species. Formerly threatened species such as the piping plover and the cricket frog are rehabilitated and delisted as endangered species. Thanks to headwater restoration projects and the creation of fish passages in Great Lakes tributaries; Brook trout, lake trout, and other anadromous fish are once again spawning in upstream areas and their reproductive success allows for self-sustaining fish populations. Isolated wetlands that are part of major flyways for waterfowl or provide other habitat functions of regional significance enjoy adequate legal protection. Past damages to critical habitat caused by navigation and flood control projects are fully mitigated. New damages are prevented by environmentally sound water resources development policies.

Future Scenario: Threats

Fish and wildlife restoration programs continue to be severely underfunded and lack an overarching ecosystem strategy. No adequate scientific decision support system has been developed, making it difficult to monitor the progress of coastal habitat restoration. The legal status of isolated wetlands is unclear; legal protection is scattered and uncoordinated among different jurisdictions.

There is no indication that the continued decrease in coastal wetland acreage is being reversed. Consequently, hydrologic and habitat functions of wetland systems are degrading

further. Many isolated wetlands have been irreversibly lost; in turn, this loss has severely reduced critical regional habitat for waterfowl and other species. Several keystone species such as the piping plover and the cricket frog are at the brink of extinction. As the fragmentation of habitat continues, the number of isolated wildlife populations and endangered species continues to rise.

Fisheries around the basin continue to suffer the consequences from unsustainable resource management and land-use practices. These pressures especially affect Coldwater fish. Physical alterations and warmer streams in the region have further decimated their habitat and spawning areas. The rise in stream temperatures is caused by global warming and exacerbated by other anthropogenic pressures such as the removal of tree cover and consumptive stream water withdrawals.

Compared to previous decades, outdoor tourism in the Great Lakes region is on the decline. These revenue losses parallel the continued loss of sport fishing opportunities around the basin. Not only is revenue being lost, there is also an ongoing need for stocking. As a result, the expenses of fisheries for maintaining fish populations have considerably increased.

D-6. Watershed Planning & Flood Mitigation

Needs:

- Improved watershed planning for integrated water resources management
- Sustainable flood protection

Current Trend

Respondents to the Great Lakes survey expressed dissatisfaction with current urban planning efforts in the Great Lakes basin with regards to sustainable flood protection. The concept of sustainable flood protection is based on the complementarity of ecological considerations and flood protection. Hence, it calls for the protection of human life and material assets while having a minimal impact on streams and allowing them to fulfill their ecological functions. One of the core principles of sustainable flood protection is the preservation of the natural retention capacity of a stream.

This implies, for example, that the natural space requirements of a stream to maintain its functions need to be considered, which adds an additional dimension to conventional urban planning. Even if urban planners are thinking forward and willingly embrace the concept of sustainable flood protection, serious conflicts over land uses are bound to take place. To successfully establish zoning plans or to be able to set space aside for a stream, affected parties, including individual property owners as well as communities, need to become participants in the planning process and take part in the search for solutions. However, it appears that in most communities there is considerable resistance to communal perspectives related to flood prevention and urban planning. This issue is a very confining factor to the success of sustainable flood management efforts, which need to look at streams and their watersheds as continuous systems that don't necessarily stop at property or community boundaries. There is a definite need for an enhanced outreach effort that can convey the benefits of watershed-based urban planning policies and sustainable flood solutions.

According to the stakeholder survey responses, existing flood control provisions, combined with available emergency response programs, appear to be doing a fair job of reducing the risk of flood hazards and damage to urban areas in floodplains in the basin. However, the collected answers also indicate that established measures for flood protection are mostly reactive in nature and that a more proactive approach may be beneficial. Proactive approaches to flood threat avoidance are based on flood risk assessments. Due to their potential to create conflict, these risk assessments need to be based on the best available assessment methods and most comprehensive coverage of affected areas. Constraints on residential and commercial land allocations and uses as well as sustainable drainage systems would have to be part of the solution.

Future Scenario: Advances

The protection of human life and material assets from flood water damage is being achieved to the fullest extent possible while having a minimal impact on the ecological function of Great Lakes tributaries. Sustainable flood protection becomes part of the basic set of tools for urban planning in river watersheds. Urban planning and watershed planning are integrated and zoning recommendations are based on both flood risk assessments and environmental considerations. Sound judgment is used for where to allow new development. Since planners follow the principles of sustainable flood protection, flood damage to urban areas in floodplains is minimized. The core principles that are followed include the preservation of natural retention capacity. Two major elements of implementing the principle are: 1) protection of stream headwaters and wetlands; and, 2) maintenance and restoration of natural riverine flow regimes by allowing adequate natural space for the stream and adjacent floodplain areas. Adequate measures are taken to prevent and mitigate flood damages in areas that are vulnerable due to the lack of consideration in development policies of the past.

Future Scenario: Threats

Flood protection in the Great Lakes basin continues without a change of mentality. For example, no significant efforts are being made to restore the hydrologic functions of streams or to protect headwaters and wetlands. Most of all, there is little change in development policies. The negative consequences include zero flood risk reduction, loss of habitat and recreational space, water quality impairments, and rising costs for the maintenance of protective structures to keep pace with water-related damages.

In the urbanized floodplains of certain Great Lakes tributaries, flood damages continue to escalate. Millions of dollars are lost in avoidable damages, due to the widespread resistance to policy changes in floodplain management and land-use planning. There is a general misunderstanding of the benefits of sustainable flood protection and also a deep mistrust toward governmental flood mitigation programs. Due to a general lack of education on watershed and flood-related-issues, federal flood mitigation programs are mainly perceived as an imposition on property owner's rights. In general, property owners and community planners lack a sense of accountability for more proactively reducing flood damage risks. However, the affected areas continue to depend heavily on federal aid after each flood disaster.

D-7. Preventing Coastal Hazards Resulting from Shoreline Erosion and Bluff Recession

Need:

- Sustainable solutions to mitigate shoreline erosion and bluff recession hazards.

Current Trend

There is a strong call for well-planned shoreline erosion solutions in Great Lakes urban coastal areas. With the growing population pressure on the Great Lakes coast, shoreline recession is becoming an increasingly important issue. Shoreline erosion is a natural process; but in many urban areas around the basin, shore alterations and development have accelerated the erosion process and magnified the hazard risks to properties and public infrastructure. The problems are traditionally addressed by building shore protection structures such as sea walls or jetties. Often, these structures impact hydraulic processes and sedimentation. As a result, some shore protection structures are now the cause of new shoreline erosion problems in adjacent areas.

Traditionally, shore protection is focused on finding sound engineering methods to prevent losses to investments in shore property and infrastructure. The Corps of Engineers has the expertise, experience, and the necessary programs to provide both structural and nonstructural shore protection solutions for problems as they occur. Too frequently, however, the shore protection is necessary due to poor planning decisions. Shoreline development continues to be planned and implemented in erosion-prone and bluff recession hazard areas.

Future Scenario: Advances

Urban waterfront development and coastal management plans are adapted to natural coastal erosion processes. Locating new structures back from the shoreline or bluff line to allow for the erosion that is expected to occur prevents future problems. Programs for the protection of public shoreline infrastructure from erosion are based on sound science and the best available hazard risk and environmental impact assessments, and are adequately funded. Program priorities minimize shoreline erosion damages by providing for: a) restoration of shores and coastal slopes that are denuded of natural vegetation; and, b) improvements of existing natural and constructed shore protection. Federal aid is available for last-resort emergency approaches to protect public facilities that are threatened by shoreline and streambank erosion.

Future Scenario: Threats

Developers continue to disregard the risks of building on sifting sands and eroding lake bluffs. Federal programs keep being focused on hazard response and do little to promulgate proactive hazard prevention. Erosion problems are "solved" by installing hard shore protection structures. There is strong dependence on and a shortage of federal resources to provide for the emergency protection of public facilities from shoreline and streambank erosion hazards.

D-8. Waterfront Rehabilitation

Need:

- Reclaim and restore degraded, abandoned, and polluted waterfront properties.

Current Trend

The Great Lakes basin is home to more than 33 million people. Four of five basin residents live in metropolitan areas. Most of these metropolitan areas are located along the Great Lakes coast and more than two out of three urban residents of the basin live in coastal counties. The Great Lakes coastal population and areas of concentration reflect the historic importance of the lakes for the region. However, since the 1960s the coastal population in the basin has steadily declined by several percentage points. In addition, there is a trend for a population shift away from densely populated urban counties to suburban coastal counties at the ever-expanding fringe of metropolitan centers. The virtually uncontrolled sprawl of low-density residential and commercial areas has become one of the most significant development issues in the basin.

The detrimental consequences of these trends are well known. Increased pollution, higher energy use for transportation and residential needs, increasing encroachment on agricultural lands and natural areas, and high-cost infrastructure requirements portend an unsustainable future. In addition, the trend has exacerbated problems confronting central city areas, such as social issues and an under-utilized, underfunded public infrastructure.

Older urban areas on the Great Lakes are still recovering from the rough transition of the manufacturing-based economy to the information age. One of the results of these economic shifts was the retreat of industries from traditional locations along the waterfront. As a result, many industrial and commercial properties near harbors are now vacant or inactive, leaving numerous waterfront areas underutilized or even abandoned.

The revitalization of the urban waterfront has become a priority issue in the Great Lakes region. The results of the stakeholder survey affirm this. Waterfront properties are, in many cases, well suited for all types of redevelopment—residential, commercial, industrial, and recreational. However, revitalization typically requires more funding and expertise than newer developments in previously undeveloped areas. This is particularly true for waterfront properties because there is both a land and a water component. Without concerted and coordinated efforts to revitalize older urban areas including waterfronts, new development continues to migrate to outlying areas and exacerbates the problem of sprawl. The majority of surveyed stakeholders indicated that efforts in the basin to reclaim and restore the urban waterfront are currently not adequate.

In many cases, real or perceived contamination is the major obstacle to the redevelopment of vacant or idle waterfront properties. Forty-five or one third of all 138 Superfund sites in the Great Lakes basin that are entered on the National Priorities List (NPL) are located in harbors or nearby areas. In addition, many abandoned properties in harbors are brownfields; i.e. they are contaminated to a less degree than listed Superfund sites and have the potential for redevelopment. Nevertheless, brownfields are stigmatized with known or suspected soil or water contamination problems and require remediation as a precursor to redevelopment. Stakeholders expressed that the clean up of contaminated areas at the urban waterfront proceeds too slow, thus hindering the progress of revitalization efforts.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 delineates authorities and responsibilities of agencies and liable parties in the Superfund program for the cleanup of hazardous waste sites. The EPA administers the Superfund program in cooperation with states and tribes. Delays in the cleanup of Superfund sites are mostly related to the general backlog of the Superfund program.

In case of brownfield remediation, authorities and responsibilities are not as clearly delineated as in the Superfund program and the situation is more complicated. Specifically, there is no federal brownfields cleanup program per se. EPA's brownfields programs provide funding, guidance, and technical assistance to states and local governments, but neither the EPA nor any other federal agency has been authorized to conduct brownfield cleanups. For brownfields on the waterfront, which have both land and water components, the determination of jurisdictions and authorities becomes even fuzzier.

Based on previous analyses, there are four key issues confounding remediation of waterfront areas: 1) environmental liability for brownfields; 2) lack of program coordination and program authority gaps for brownfield remediation; 3) limited and inconsistent authorities for environmental remediation at the urban waterfront; and, 4) lack of coherence between remedial action and redevelopment programs.

1) Financial liability for brownfields. Redevelopment is a criterion for eligibility under many state programs for brownfield cleanup. Yet the potential financial liability of buying these sites or providing loans for redevelopment deters potential developers and loan providers. To address this problem, the states have developed liability relief mechanisms that allow private parties to buy, sell, or redevelop properties without being liable for contamination they did not cause. Although these incentives have considerably increased investment in brownfields, stigmatization is still a major deterrent to redevelopment.

2) Limited coordination and program authorities for brownfield remediation. Many agencies can be involved but the authorities and responsibilities are not as clearly defined and coordinated as for Superfund cleanups. Each of the Great Lakes states has a voluntary cleanup, brownfields remediation, and/or environmental response program. The EPA provides support in the form of grants to administer state programs (brownfields assessments, revolving loan funds, and cleanup grants). However, the EPA does not have the authority to conduct brownfield remediation and redevelopment. And neither the EPA nor the states have the technical capabilities and engineering expertise to manage redevelopment projects. The Corps has the specific cleanup and engineering expertise, but its authorities are limited to projects where there is a nexus between the remediation project and a water resources or waterway issue (Section 1135, WRDA 1986; Section 312, WRDA 1990; Section 401, WRDA 1990; see Appendix B-1). The Corps can also assist with brownfield remediation through its Technical and Planning Support for States program (Section 22, WRDA 1974), but its application is limited by the ability of partners to match the 50% cost-share requirement. In addition, the Corps has been involved in brownfield remediation by virtue of exerting the Support For Others authority.

3) Limited and inconsistent authorities for environmental remediation at the urban waterfront. The "balkanization" of authorities for environmental remediation at the land-water interface adds more hurdles to coordinated and concerted efforts for urban waterfront revitalization. Depending on the location of a contaminated waterfront site, the remedial action may fall under the jurisdiction of several federal agencies and/or the local governments or port authorities.

GLNPO is charged with the coordination of RAP-based sediment remediation in Great Lakes AOCs but was criticized by the GAO for failing to effectively define organizational responsibilities for the oversight of these cleanups. If coastal federal trust resources are involved, FWS or NOAA will be involved in the remediation effort.

The Corps of Engineers has authority to remove contaminated material from navigation channels and adjacent areas. In contrast to other federal agencies, the Corps has the specific cleanup and engineering expertise to implement and manage remediation projects that, for example, involve the dredging of contaminated sediments or the containment of contaminants--a common practice in brownfields revitalization--by construction of shoreline armor and other engineered controls and barriers. However, as previously discussed, the Corps has limited authorities to extend the use of its capacities beyond navigation channels and Superfund sites formerly utilized by the Department of Energy (FUSRAP, Formerly Utilized Sites Remedial Action Program).

A new authority for waterfront restoration and remediation would allow the Corps to fully apply its expertise to contaminated waterfronts. But efforts to advocate for such an authority have so far met with resistance, partly due to a congressional reluctance to the upland expansion of Corps authorities. Nonetheless, the Great Lakes Commission has given testimony before the House Water Resources and Environment Subcommittee requesting such a new Corps authority in the WRDA reauthorization bill of 2002.

4) Lack of coherence between remedial action and redevelopment programs. Several states have adopted comprehensive programs that tie brownfield remediation and redevelopment together. These include Michigan's Clean Michigan Initiative (CMI), which makes cleanup funding available under the condition that there is an economic redevelopment plan or, at least, a tangible interest in the redevelopment of a proposed site. Other comprehensive state programs for brownfield revitalization include Wisconsin's Brownfields Grant Program and the New York's Clean Water and Clean Air Bond Act.

CMI alone allocates $335 million to clean up contaminated sites and to promote brownfield redevelopment. A $50 million portion of these funds was specifically destined for waterfront revitalization and has already been apportioned to suitable projects. Yet, survey responses indicate that the regional needs for waterfront remediation and restoration exceed the capacities of existing programs. In part, this may be ascribed to the lack of federal authorities with funding capability for the waterfront. In addition, there is no federal agency coordination among those existing environmental remediation authorities that apply to the waterfront, nor with regional or local initiatives for economic redevelopment.

The state-federal Coastal Zone Management Program (CZM) might be a suitable vehicle to tie remedial actions and redevelopment together. The CZM already specifies the sustenance, development, and revitalization of urban waterfronts as a strategic goal. At this time, however, the remediation of polluted waterfronts is not specified in its strategic framework as being part of the supported revitalization efforts. Waterfront remediation and restoration issues are also outside of the national priority areas of the Coastal Zone Management Enhancement Grants Program, which provides additional funding incentives to states to improve their Coastal Management Plans and make them more consistent with national goals. Under the current CZM framework, it is therefore unlikely that state coastal management programs will make urban waterfront issues a funding and management plan priority.

Future Scenario: Advances

A bright future will see more concerted and better coordinated efforts to reclaim, remediate, and restore the urban waterfront. Comprehensive waterfront remediation and redevelopment programs make funding resources available and maximize their efficiency through coordination of authorities. The expertise of relevant institutions is maximized by providing them with the necessary authorities and with an efficient coordination mechanism across agencies and organizations. Such a scenario might hold a networking role for CZM that provides funding incentives to develop consistent, waterfront-related objectives for brownfield programs of the states. The CZM would also provide enhancement grants to state coastal management programs that incorporate waterfront revitalization as an element. Waterfront management plans of local authorities are consistent with the state CZM. All superfund sites and brownfield sites will eventually be cleaned up and rehabilitated.

Future Scenario: Threats

Waterfront revitalization efforts continue to be sporadic and have a lackluster regional profile. Due to the lack of coordination and resource consolidation, finite resources are exhausted before program goals are achieved. There is no unified national initiative to address the continued decay of the urban waterfront, no agency is being charged to coordinate oversight and implementation of remediation efforts. As a result, waterfront areas continue to be plagued with abandoned and contaminated properties. This adds to ongoing problems concerning the chronic delay of cleaning up Superfund sites and AOCs. The sum of these trends is detrimental to the attempts of older urban areas and harbors to raise their residential, economic, and recreational profile. New development continues to migrate to the outskirts of metropolitan areas, with all the adverse effects of sprawl.

D-9. Soil Erosion Prevention

Need:

- Reduce excess sediment and nutrient loadings to the Great Lakes.

Current Trend

During the 1970s and 1980s, the installation of wastewater treatment plants drastically reduced nutrient loadings from point sources. These point-source pollution controls allowed the recovery of the Great Lakes from their worst conditions in the 1960s. Nonpoint sources (NPS), mostly from urban and agricultural runoff, are now the leading pollution pathway to the Great Lakes. Programmatic efforts to address non-point source pollution source have further reduced nutrient loadings to the lakes. Best management practices were implemented for soil erosion prevention, stormwater retention, and other effective strategies of NPS control. In the mid-1990s, downward trends in sediment and nutrient loadings to the lakes started leveling off. Runoff from urban and agricultural land continues to deposit thousands of tons of eroded, nutrient-rich topsoil into the lakes each year.

There seems to be a sentiment among stakeholders that the problem is perpetual, even though numerous programs are in place and millions of dollars are being spent to address these issues. A recent high-profile setback is the reversal of trends in Lake Erie, which is once again plagued by algal blooms and an oxygen-depleted “dead zone.” These phenomena are associated

with an increasing trend in nutrient concentrations in the water observed over the past eight years during the spring runoff.

At the core of the problem are land-use practices, such as unregulated low-density development or removing vegetative covers from streambanks and the continued use of intensive tillage from cropland. Such activities are particularly detrimental to the recovery of the Great Lakes ecosystem because they simultaneously degrade the environment and are also unsustainable from an economic point of view.

Stakeholders were almost evenly split in their evaluation of current efforts to prevent siltation and excess nutrients in the basin: 44% rated these efforts as "somewhat adequate" and 43% rated them as "inadequate". The respondents pointed to a number of factors that impede programmatic efforts to further reduce sediment and nutrient loadings. The identified shortcomings fall into five categories:

1) *Lack of coordination*. As can be seen from Tables 5.1 and 5.2, there are many programs that address one or the other aspect of NPS control. A number of different federal and state agencies are involved, including the EPA, NRCS, NOAA, the Corps, as well as state departments for natural resources, pollution control, and agriculture. As is true for most of the other facets of Great Lakes restoration, there is no effective mechanism to coordinate the activities of all these entities, and the current approach to address sediment and nutrient control is compartmentalized, thus mitigating against coordinated success on a larger scale.

- Example 1: In the survey, a stakeholder referred to the problem of dissociating soil management in upper watersheds from the RAP process, since soil erosion and sediment transport from upper watersheds compound the management of contaminated sediments in downstream AOCs. When less polluted sediments from the upper watershed settle out in the harbors, they usually add to the remediation costs by increasing the volume of sediments that needs to be dredged and either deposited in a CDF or treated. In a few cases, the sedimentation may be beneficial by providing an effective means of capping the toxic sediments. The Maumee River RAP responds to the need for watershed-based sediment management by including an upland erosion component.
- Example 2: Due to the complexity of nonpoint source issues and the institutional plethora involved in their management, there are jurisdictional and program authority overlaps of different agencies. The lack of a coordinating mechanism adds to the confusion. Both the NRCS and the Corps offer technical assistance for water quality protection, resource conservation, and ecosystem restoration, without any visible efforts to coordinate these programs.
- Example 3: The Corps has the authority to develop sediment transport models for Great Lakes tributaries. However, the authority does not extend beyond the modeling effort. Different agencies are in charge of developing and implementing BMPs. It follows that both the usefulness and the successful application of the models depend strongly on a well-coordinated partnership among the agencies involved. The Corps is therefore coordinating this

program with NRCS, ESEPA, USGS, the Great Lakes states, and the Great Lakes Commission.

2) *Lack of funding*. Federal NPS control programs seem to be plagued by fewer funding problems than other restoration activities. However, many of these programs have matching fund requirements for the participating state agencies and state budgets are currently depleted, with the result of funding shortages in the region. In addition, the USDA and USEPA have reduced technical personnel in recent years, leaving a majority of NPS programs understaffed. The shortage of program management staff reduces the efficiency of program funds and limits the capabilities for program coordination.

3) *Program priorities*. One strategy to NPS reduction that has been somewhat overlooked is to put the programmatic focus directly on sediment reduction in streams and lakes. After all, sediments are eroded soils and are the main source of nutrients to the lakes. On top of transporting other pollutants, excess silt physically destroys aquatic habitat and creates costly problems for navigation interests, water treatment facilities, and other water use sectors.

4) *Lack of scientific data and performance measurements*. The lack of science on soil and sediment transport undermines the value of current programs, brings up questions about science-based decision support tools, and erodes advocacy and educational efforts to address NPS problems.

- Example 1: The strongest arguments for soil conservation are the economic and environmental losses of erosion. The argument is weakened by the lack of recent research to quantify and assess these losses.
- Example 2: Federal and state agencies advocate the use of buffer strips (small areas of land in permanent vegetation) and other soil conservation measures in agricultural lands to mitigate the movement of sediments, nutrients, and pesticides. However, there has been little research to evaluate which soil conservation techniques are most suitable for the soil types and topography found in the Great Lakes region.
- Example 3: There is a lack of baseline data for science-based watershed planning tools, such as tributary models. The Corps is developing mathematical sediment models for Great Lakes tributaries (Section 516(e), WRDA of 1996) but has not been involved in data gathering and coordination.

5) *Lack of awareness*. Most of the current strategies are based on the premise that farmers and other stakeholders want to apply soil conservation and other best management practices in order to protect their own interests, which also protects the interests of the larger basin community. Most programs are based on voluntary compliance. Hence, the success of current strategies requires that these groups understand the economic threats of unsustainable land-use practices and also the environmental impacts of their actions. However, several comments of surveyed stakeholders suggest that the causes and effects of nonpoint pollution--for example, the connection between agricultural runoff and water quality--are not necessarily common knowledge. It appears that not enough is being done in terms of outreach, even though many programs have the capability to fund education initiatives and demonstration projects. The Great Lakes Basin Program for Soil Erosion and Sediment Control funds projects for educational purposes, but has a different main focus.

Future Scenario: Advances

The NPS goals of the GLWQA are being met. A commonly shared vision for an ecologically and economically sustainable ecosystem in the Great Lakes basin is the basis for strategies to conquer the problem of excess sediment and nutrient loadings in lakes and streams. These strategies are coordinated by a strong institutional mechanism and tied into an overarching Great Lakes restoration plan. The restoration plan sets the goals for NPS elimination strategies and the strategies have focused objectives and measurable targets. Major strategic goals include: sediment reduction for each major river basin; a science-based decision support system (based on tributary models) to guide BMPs; a permit system for sediment discharges (analogous to NPS permitting); taxing of nutrient discharges; a collaborative education campaign involving environmental and agricultural interests which will educate zoning boards, elected officials, and farmers about BMPs; planning and implementation of sustainable land-uses; renaturalization of stream corridors; and, integrated watershed-based sediment management. Sediment loadings of Great Lakes tributaries are significantly lowered. One of the major benefits is the associated drop in the overall costs of maintaining Great Lakes navigation channels due to the reduced need for dredging.

Future Scenario: Threats

Despite the continuous calls for more coordination among agencies, there is no leader that takes on the important task of basinwide coordination of NPS control. Ongoing strategies have a lack of vision, are disconnected and ineffective. NPS pollution will remain a significant issue thwarting all efforts to battle it. There is a continued disconnect between upstream watershed activities causing soil erosion and concerns of downstream interests about sediment and nutrient loadings. The lack of success of expensive federal programs gradually erodes funding for NPS control. The continued problem with excess sediment loadings in Great Lakes tributaries exacerbates the maintenance dredging backlog of the Corps.

D-10. Monitoring and Management of Great Lakes Water Levels and Withdrawals

Need:

- Prevent net loss of water from the Great Lakes.

Current Trend

Many stakeholders are deeply concerned about the possibility that unregulated water withdrawals from the basin may upset the Great Lakes water balance. This is a special concern because there is presently no binding, interjurisdictional agreement to effectively preclude the draining of Great Lakes aquifers from either outside or within the basin. To safeguard against any future diversions or other extensive withdrawals of this type, an international treaty between the U.S. and Canada would be needed. But such an international agreement is still missing.

What role does the Corps have in preventing water losses form the Great Lakes basin? While the Corps does not have the authority to control withdrawals from the Great Lakes, it provides various advisory and engineering services in support of water level maintenance in the basin. The Corps measures and forecasts lake levels; operates the artificial outflows from Lake Superior and Lake Ontario; is charged with accounting for the Lake Michigan diversion at Chicago, Illinois; and coordinates data exchange with Canada's Maritime Navigation Services

for the Welland Canal outflow control and with the State of New York for the New York State Barge Canal Diversion. Last but not least, the Corps also provides outreach services and informs decision-makers and the public on lake levels and related hydrologic issues.

Concerning the role of the Corps in Great Lakes water level and water balance management, there are three interrelated yet distinct issues that need to be discerned: 1) a possible drop in lake levels due to a long-term shift in the Great Lakes water balance as a result of substantial withdrawals or climate change, or a combination of both; 2) concerns over low lake levels caused by the natural cycle of periodic water balance fluctuations; 3) the ability of the Corps to manipulate annual lake level fluctuations of Lakes Superior and Ontario by temporarily accelerating or decelerating the flow of water from these lakes.

All three of the above water level issues have profound effects on natural resources management and uses in the Great Lakes basin:

1) Dropping water tables would have adverse consequences for most water users in the basin. The effects might include supply shortages, higher water and water infrastructure costs, and impaired water quality. Lower lake levels would impact maritime transportation and recreational boating along with the associated industries. Shore damages due to erosion and bluff recession would increase. Lower water tables would also significantly change the regional ecology and threaten much of the present wetland habitat.

2) Extremely high lake levels regularly result in flood emergencies and shore damage, whereas extremely low levels impact navigation and other water uses.

3) Extreme annual fluctuations on Lake Ontario cause problems for navigation interests, hydropower producers, and shoreline properties; but the absence of any fluctuations is deleterious to the lake's coastal ecology.

Despite the far-reaching impacts of water level-related issues, there is a pattern of reacting to floods or dry spells as they occur or addressing water level-related user conflicts only as they arise. Most interests seem to agree that a more proactive approach to crisis prevention or mitigation is needed. Stakeholder comments pointed to a lack of information among affected interests as being part of the problem. The Corps' outreach could meet some of these information needs but currently seems far from filling the gap. The Corps has staff with appropriate expertise on water level and balance-related issues, yet its outreach efforts are historically reactive rather than proactive. That is, there are significant outreach initiatives during periods of extremes but they cease to exist once life returns to "normal." In the intervals between extremely high or low lake levels, neither the staffing nor the funding is provided to maintain an effective extension program that explains lake level issues and what role people's decisions and actions have in either exacerbating or alleviating potential problems.

A comparison between the time scale for long-term water level fluctuations and the turnover of lakeshore property ownership illustrates this need for a continuous extension program. According to a social survey conducted by the Levels Reference Study Board of the IJC in 1993, 48 % of lakeshore property owners on the U.S. side of the basin have owned their properties for less than 15 years. Extreme high or low lake levels appear to return every 25 – 35 years. In periods between extremes, questionable planning and development decisions are often made. For example, owners invest in homes and structures on receding bluffs or in places that were formerly inundated by floodwaters. According to the survey of the Levels Reference Study

Board, 60% of those lakeshore owners in the basin who experienced flooding were unaware of that risk when they purchased their property. Almost half of the respondents who experienced erosion damage were not aware of the erosion risk when they purchased their property.

Closely related to the need for an effective extension program is the need for a well-coordinated media relations program. The Corps and its program activities often enter the media main slots either due to controversies about projects, during crises (such as low lake levels), or all-out emergencies (Lake Erie and Fort Wayne floods). A well-functioning media relations program might go a long way toward providing accurate information on water level and balance-related issues on a continuous basis. It would thus be a part of proactive hazard mitigation strategies. It might also prevent the Corps from being vilified due to misinformation, as has occurred in the past. For example, during the Lake Erie floods in the 1980s, the Corps was blamed by some in the public for unduly manipulating lake levels, even though its limited authority for changing the Lake Ontario and Lake Superior outflows could not have possibly averted the emergency situation. A stronger outreach program of the Corps would meet two major needs: 1) education for riparian property owners and municipal planners; and, 2) provide the Corps with a tool to clearly convey its authorities and responsibilities with respect to Great Lakes water levels and diversions.

In the Great Lakes survey (Appendix C – Part A: Section 6.3), respondents rated as "Somewhat adequate" the following water management efforts:

- Forecasting long-term trends in lake levels;
- Negotiating Great Lakes outflows among affected interests;
- Studying and assessing criteria for regulating Great Lakes outflows; and,
- Accounting for Great Lakes water diversions.

All these management efforts are closely tied to the Corps' water control activities. An interpretative analysis of the survey results in relation to current trends yields the following picture:

Forecasting long-term trends in lake levels. Based on state-of-the-art modeling, current lake level forecasts are limited to a range of six months. There are slightly differing opinions about the possibilities of extending these forecasts into the future. Some experts estimate that lake level forecasts could be extended to look one to three years ahead in time. Some others believe that reliable forecasts will only be possible for twelve months in advance, based on current resources and the state of the technology. There seems to be agreement that an extension of lake level forecasting to one year is not only feasible but also economically desirable.

Negotiating Great Lakes outflows among affected interests. The IJC International St. Lawrence River Board of Control is in charge of negotiating Lake Ontario outflow regulations. The board is co-chaired by the Canadian Coast Guard and the U.S. Army Corps of Engineers and has been successful in bringing representatives for all affected interests (navigation, hydropower, environment, water supply) to the table. In addition, the Board holds regular multi-city teleconferences to increase public input about local conditions and impacts of concern related to water levels and flows in Lake Ontario and the St. Lawrence River. The IJC International Lake Superior Board of Control, on the other hand, is often criticized for not meeting its purpose of providing a forum for equal-footed negotiation of all interests.

For example, the four-member U.S. section of the Board is chaired by the Corps and has two additional Corps engineers as well as an additional civil engineer as members. Criticism extends to the public meetings: meeting locations are not effectively advertised and public participation is poor. There are also concerns about the lack of efforts by the board to include focus groups in discussions; different interests (navigation, recreation, environment, shoreline owners, and tribes) have no effective forum to discuss and negotiate water control-related issues.

Studying and assessing criteria for regulating Great Lakes outflows. The Corps has taken a proactive leadership role for the *Plan of Study for Criteria Review in the Orders of Approval for Regulation of Lake Ontario – St. Lawrence River Levels and Flows* and for the *Upper Great Lakes Plan of Study*, both prepared by the respective IJC Boards of Study. Conducted under the auspices of the IJC, these studies are considered to be well rounded and scientifically defendable. However, an inherent problem with these studies appears to be the long time interval between periodic assessments of the outflow regulation criteria. The IJC issued the directive for the *Upper Great Lakes Plan of Study* (POS) in August 2001; 22 years after the regulation criteria were last reviewed in 1979. In addition, it is taking the POS teams decades to complete these types of studies.

The problem with these delays may be related to the perpetual rotation of POS team members. It appears to be also an issue of efficient sharing of data collection and data coordination responsibilities. Parts of these studies take decades to complete and are already dated by the time they are released. Take for example the assessment of potential shoreline damages due to changing water levels. In 1996, the Detroit District provided a comprehensive assessment of potential shore damages due to changes in Lake Michigan levels. The Buffalo District has studied local and regional erosion impacts associated with coastal projects on Lakes Erie and Ontario. Thus, the shoreline damage assessment data for the U.S. side of the basin are incomplete and inconsistent and no similar effort has yet been initiated on the Canadian side. The POS team is currently evaluating whether the obtained information allows inferring relative impacts of water levels on coastal areas of the upper Great Lakes.

Accounting for Great Lakes water diversions. The existing monitoring network has the capacity to account for Great Lakes outflows and artificial diversions, such as the Lake Michigan diversion. Major uncertainties in calculating the Great Lakes water balance are caused by a limited understanding of the role of surface-groundwater interactions and cumulative water withdrawals within the basin (e.g. for irrigation purposes).

The most significant Corps authority with regards to Great Lakes water diversions is Lake Michigan Diversion Accounting (Section 1142, WRDA 1986; see Appendix B – Section 6.2). The Corps is equipped to gauge the diversion to an accuracy of +/- 50 cfs. However, there is a considerable lag between taking the measurements and reporting the data for any particular water year (WY). Currently, the latest Lake Michigan Diversion Accounting Report is for WY 1998 and was released in 1999.

Future Scenario: Advances

From a regional perspective, an ideal future will hold no changes to the hydrologic balance of the Great Lakes. While the prevention of major water diversions seems well within the range of possibilities, there is only a remote chance that projected economic and social developments inside the basin will leave the water balance of the Great Lakes unaffected. Any likely future scenario will include a situation where the total amount of water taken by a

multitude of minor consumptive uses and diversions exceeds the net withdrawal by major diversions. Still little is known about the actual and possible impacts of cumulative minor withdrawals on the regional water balance. Also, there are considerable uncertainties with regards to the amount of exported water that is still unaccounted for.

In the most hopeful (and most unlikely) future scenario, a binding international agreement spells out policies to prevent any future diversions affecting the Great Lakes hydrologic balance, regardless of their nature. The new treaty sets forth a set of comprehensive, clear, and consistent rules for Great Lakes water management. It also provides a framework for water management coordination and defines the responsibilities of involved agencies in both federal governments and the Great Lakes states and provinces.

A strong outreach effort engages the public and the regional stakeholders in water management issues. Active, regular information programs are available describing the Great Lakes hydrologic balance and its complexity. Particularly, these programs emphasize how natural processes and artificial controls impact the system and how they interact.

In a prospering future, well-informed public policy decisions ensure the sustainable use and management of water volumes in the Great Lakes basin. Well-informed public policy decisions require predictions of future water demands, which, in turn, depend on continuously updated water use data that allows, for example, reliable demographic and land-use projections. The data can be generated with existing methods and techniques but will require a substantial investment in data standardization and coordination. Land-use data gathering and projections are a local rather than a state or federal responsibility, which creates a challenge that needs to be overcome. A federal agency, such as the Corps of Engineers, will provide the necessary funding (by means of a cost-share approach) to coordinate a standardized data management system for demographic and land-use projections.

Forecasting long-term trends in lake levels: Modeling advances will lead to modest improvements in lake level forecasting. The improved models will be capable of accurately predicting lake levels 18 months into the future.

Negotiating Great Lakes outflows among affected interests: All stakeholders will be included in the negotiations and have a voice. Differences will be articulated but antagonistic situations will be dissipated through a collaborative negotiation process. Brokered compromises balance the needs of all affected interests.

Studying and assessing criteria for regulating Great Lakes outflows: A robust, comprehensive, and accurate decision-support system will be developed. The decision-support system is based on a numerical, deterministic model that takes into consideration the benefits and risks for each user sector and minimizes estimated losses to all users. The deterministic model is the result of improved forecasting abilities for regional trends. The much-needed improvements include more detailed economic evaluations as well as advances in hydrologic and meteorological modeling made possible through well-funded research initiatives.

Accounting for Great Lakes water diversions: Accurate and timely measurements are available for access by decision-makers within a very short period of time.

Future Scenario: Threats

A brand-new international agreement, brokered without a real commitment by the federal governments, fails to adequately protect water resources in the Great Lakes basin. The agreement has too little clout, partly because it falls short of specifying the federal role in water resources management. In addition, it does not address consumptive uses and has too many loopholes to be effectively applied.

Water industries and water-needy regions increasingly seek to sell and export Great Lakes water. Water shortages in areas immediately adjacent to the Great Lakes surface water divide are one of the biggest issues. Water shortages have become a regular occurrence in certain parts of Illinois, Indiana, New York, Ohio, Pennsylvania, and Wisconsin. The shortages are immediately linked to the reluctant adoption of conservation measures in these areas. Wasteful water use and irrigation practices gradually deplete regional aquifers. The problem is exacerbated by the lack of knowledge about the surface-groundwater connection within the basin and across watersheds. Thus, no effective measures can be taken to prevent the slump of water tables around the Great Lakes.

The cumulative water withdrawals are believed to contribute to the problem of low lake levels. And once again, the Corps of Engineers is associated with many of the emerging water level problems. There are considerable misconceptions in the public and in the media about the Corps' ability to manage water levels in the region. The Corps seems unable to get the message across that it does not control water levels but the timing of flows with effects on the annual cycle; that the climate not the Corps of Engineers controls the amount of water in the lakes. The misconceptions are a direct result of a reduced commitment to educating new coastal residents and water users on the complexities of the Great Lakes hydrologic system.

Although the increasing pressure on water resources is felt in the basin, there is still no reliable model with which to predict future water demands. Past trends in program funding continue into the present; allocations are inadequate for timely coordination and standardization of demographic and land-use data. As a result, more years are required to develop reliable model predictions. Changing land and water use patterns exacerbate the issue and diminish the value of the delayed model predictions for water demands.

Forecasting long-term trends in lake levels: Chronically low funding levels erode the Corps' lake level forecasting ability. The weak performance of the program has an adverse effect on its acceptance by the public and considerable friction with the media and the policy sector is the result.

Negotiating Great Lakes outflows among affected interests: The Corps of Engineers is perceived as favoring certain stakeholders over others in outflow negotiations. This leads to accusations of cronyism and that the Corps manipulates water levels for the benefit of its cronies. Negotiations of Lake Ontario and Lake Superior outflows become a highly politically charged issue.

Studying and assessing criteria for regulating Great Lakes outflows: The Plans of Study (POS) for assessing outflow regulation criteria for Lakes Ontario and Superior crafted by the Corps of Engineers do not stand up against an objective external review. Since these studies take an unduly long time to complete, they are not keeping up with changing water resources use patterns in the basin. In addition, critics say, they are flawed by underestimating the economic

implications of some sectors that are traditionally not considered as "economic" (e.g. outdoor recreation). Moreover, they are heavily criticized for underestimating the long-term value of ecological sustainability.

Accounting for Great Lakes water diversions: The reporting of Lake Michigan Diversion data continues to be severely delayed. The potentially positive value of diversion accounting to manage Great Lakes water volumes is overshadowed negatively by the magnitude of water withdrawals that are unaccounted for. Continued diversion accounting does little in terms of preventing irreversible water withdrawals. Great Lakes water management authorities have failed to acquire the ability to assess future water demands and monitor cumulative minor withdrawals from the basin.

D-11. Program and Project Management and Planning

Need:

- The Corps needs to more efficiently plan and manage programs and projects in the Great Lakes basin.

Current Trend

As can be seen from a number of strategic documents recently released by the Corps (i.e. *USACE* 2012, Draft *Civil Works Program Strategic Plan FY 2003 – FY* 2008, *National Report on Identified Water Resources Challenges and Water Challenge Areas*), the organization embraces the need for increased cooperation with partners to solve present and future water resources challenges.

Two of three surveyed stakeholders approve of their *interaction* with the Corps' Great Lakes districts (72% rate their interaction with the Corps as good, adequate, or very good). Even though *communication and information exchange* issues have been identified as some of the main concerns about interactions with the Corps in the national assessment (*National Report on Identified Water Resources Challenges and Water Challenge Areas*), 44% of surveyed stakeholders indicate that they are satisfied, if not completely satisfied with their interaction with the Great Lakes districts. It appears that the districts are, for the most part, on the right track with their efforts to communicate and exchange information with their partners. On the other hand, there remains a lot of room for improvements: twenty-nine percent (29%) of the Great Lakes stakeholders said they are only somewhat satisfied with how the Corps interacts with them and 20% indicated dissatisfaction. One issue that was specifically pointed out is the lack of transparency of the Corps' decision-making process.

"Project processes" is one of the ten major water resources challenges for the Corps identified in listening sessions across the nation during the year 2000. Great Lakes stakeholders gave the Corps *business process* a lackluster approval: 51% are "somewhat satisfied" with the current process, while only 13% are "satisfied" or "completely satisfied", and 30% indicated dissatisfaction. There appears to be a lot of room for improvement for the business process. This implies that if the Corps successfully reforms its' current business processes (i.e., accelerate project development and implementation) then the value of its programs and projects to the Great Lakes region will be enhanced.

Due to the lack of a basinwide *strategy*, the Corps involvement in Great Lakes management and restoration has so far been mostly on a project-by-project basis. Improvements

to current strategies can be expected if the Corps abandons this piecemeal approach in favor of a collaborative watershed-based planning approach. One of the newer programs (Great Lakes Fishery & Ecosystem Restoration; Section 506, WRDA 2000) sets a precedent and embraces the need for a cooperative, basinwide approach. The program requires a basinwide program management plan and coordination with all affected interests.

Another new program management aspect of Section 506 is the requirement to develop an evaluation program. Surveyed Great Lakes stakeholders indicated they were only semi-satisfied with the accomplishments and results of their interaction with the Corps. This implies unmet needs that could be addressed through a result-oriented performance assessment process for Corps Great Lakes programs with measures for the success of coordination and collaboration efforts.

In the period of FY 1992 – FY 2002, of the 257 projects that were studied for construction under CAP authorities, 34 were implemented and constructed (see Appendix E). This means that only slightly more than one of ten considered projects have been built and completed. Regardless of the specific barriers and circumstances, stakeholders experience this failure to implement planned projects as a source of frustration.

Future Scenario: Advances

The Corps reform streamlines project processes. The Great Lakes districts are able to implement projects more efficiently and effectively. They also continue to improve processes for cooperation, communication, and information sharing.

Future Scenario: Threats

There will be no significant improvements to program and project management processes. Time-consuming and inefficient program management and project development hamper the Corps' capability to effectively and efficiently address regional needs.